Climate Change Impacts on Abundance and Distribution of Traditional Foods and Medicines – Effects on a First Nation and Their Capacity to Adapt

FINAL REPORT

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CIER
CENTRE FOR INDIGENOUS ENVIRONMENTAL RESOURCES

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CIER, the Centre for Indigenous Environmental Resources, is a national First Nation-directed environmental non-profit organisation. We offer research, advisory, and education and training services to Indigenous communities, governments and private companies in four interconnected topic areas: forests, climate change, water, and sustainability.

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EXECUTIVE SUMMARY

Many First Nations within the boreal region of Canada continue to harvest traditional foods and medicines that serve an integral role in maintaining community wellbeing. Climate change impacts on species abundance and distribution has great potential to affect the day-to-day lives of First Nations in Manitoba. However, these impacts have not been fully investigated or documented in many First Nations. To address this issue, The Centre for Indigenous Environmental Resources (CIER) and Black River First Nation (BRFN) undertook the Climate Change Impacts on Abundance and Distribution of Traditional Foods and Medicines project to increase the understanding of how climate change is affecting First Nations in the boreal region of Canada.

CIER accessed funding for this project from the Aboriginal and Northern Community Action Program, Impacts and Adaptation Fund, administered by Indian and Northern Affairs Canada (INAC). CIER worked with BRFN as an example boreal First Nation that expressed a keen interest in examining the effects of climate change.

The goals of the project were to:

- Raise awareness to the impacts of climate change on traditional foods and medicines at Black River First Nation (BRFN).
- Understand how climate change may be affecting abundance and distribution of selected traditional foods and medicines at BRFN and other First Nations in the boreal region.
- Increase the capacity of BRFN, and potentially other First Nations in the boreal region, to plan for changes in traditional foods and medicines due to climate change and develop adaptation strategies to deal with those changes.

CIER met the goals of this project through community-based work including presentations to BRFN and community interviews, as well as external research to investigate the effects of climate change on selected traditional foods and medicines that are important at BRFN. CIER researched potential climate change adaptation strategies for First Nations in the boreal region. In addition, CIER shared the project outcomes with the community of BRFN through presentations and a written report.

Community-based research indicated that traditional foods and medicines, while not used as much as in the past, are still important to the people of BRFN. This study focused on conifer trees, berry plants, and moose that are currently important for health and nutrition of the community and also have spiritual and cultural importance.

BRFN community members have noticed climate changes including milder winters, less snow, drier summers, and more unpredictable weather. BRFN members had concerns regarding the impacts of timber harvesting, a nearby pulp mill, and hydro dams on traditional foods and medicines in the area. Since these other environmental issues are so prevalent at BRFN, it was difficult to attribute observed changes in abundance and distribution of traditional foods and medicines to climate change. However, community members did identify climate change related impacts on their traditional foods and medicines. Two main observations were:

- Greater occurrence of berries drying up before coming to fruit
- Spruce budworm infestations affecting conifer trees

Additionally, presentations for the project stimulated discussions with community members and increased awareness about how climate change can affect the distribution and abundance of their traditional foods and medicines.

Our external research found that all of the traditional foods and medicines that we focused on at BRFN are vulnerable to climate change. For example, conifer trees are susceptible to drought and insect infestations, berry plants are affected by changes in moisture conditions, and moose are vulnerable to changes in habitat and diseases. The climate changes observed by BRFN appear to correspond with predictions that scientists have made for the boreal region such as increased temperatures and unpredictable weather.

Knowledge gaps need to be filled. More climate change information exists for Arctic regions of Canada (ACIA 2004) than for southern boreal forest areas such as where the community of BRFN is located. First Nations could benefit from further study specific to traditional foods and medicines in the boreal forest, such as the effect of climate change on berry plants or on mammals such as rabbits.

CIER also researched potential adaptation strategies to address the effects of climate change on traditional foods and medicines at BRFN and other First Nations in the boreal region. Suggested adaptation strategies were to:

- Plant trees
- Control spruce budworm
- Build shade structures (for berry plants)
- Change plant harvesting locations and times
- Adjust hunting activities
- Share and exchange traditional foods

Several mitigation strategies to reduce greenhouse gas emissions were also discussed including setting up a recycling program, improving sustainable transportation, and constructing energy efficient buildings.

The BRFN community is aware of the potential impacts of climate change, and with sufficient funding and capacity building measures in place, could conduct further research or planning for adaptation strategies. BRFN has shown a keen interest in environmental education and research in their community through the creation of a BRFN Environment Department and involvement of youth in a global warming monitoring project. Unfortunately, due to inadequate funding, limited human resources and other factors, these initiatives were suspended. CIER's Climate Change Planning Tools Guidebooks (which were provided to BRFN) can assist with planning for adaptation strategies.

Continuation of programs such as BRFN's Global Warming Monitoring Program would be useful in filling knowledge gaps on the long-term effects of climate change on traditional foods and medicines in the boreal region. Monitoring will help First Nations communities prepare strategies to adapt to any changes in abundance and distribution of traditional foods and medicines that may occur with a changing climate. It would be useful for the findings of this study to be made available to other First Nations in the boreal region to assist with similar research projects or during adaptation planning processes.

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1.0 Introduction

The Centre for Indigenous Environmental Resources (CIER) and Black River First Nation (BRFN) undertook the Climate Change Impacts on Abundance and Distribution of Traditional Foods and Medicines project to increase the understanding of how climate change is affecting First Nations in the boreal region of Canada. CIER worked with BRFN as an example boreal First Nation community as they are situated in the boreal region (Figure 1). Furthermore, BRFN expressed a keen interest in examining the effects of climate change.

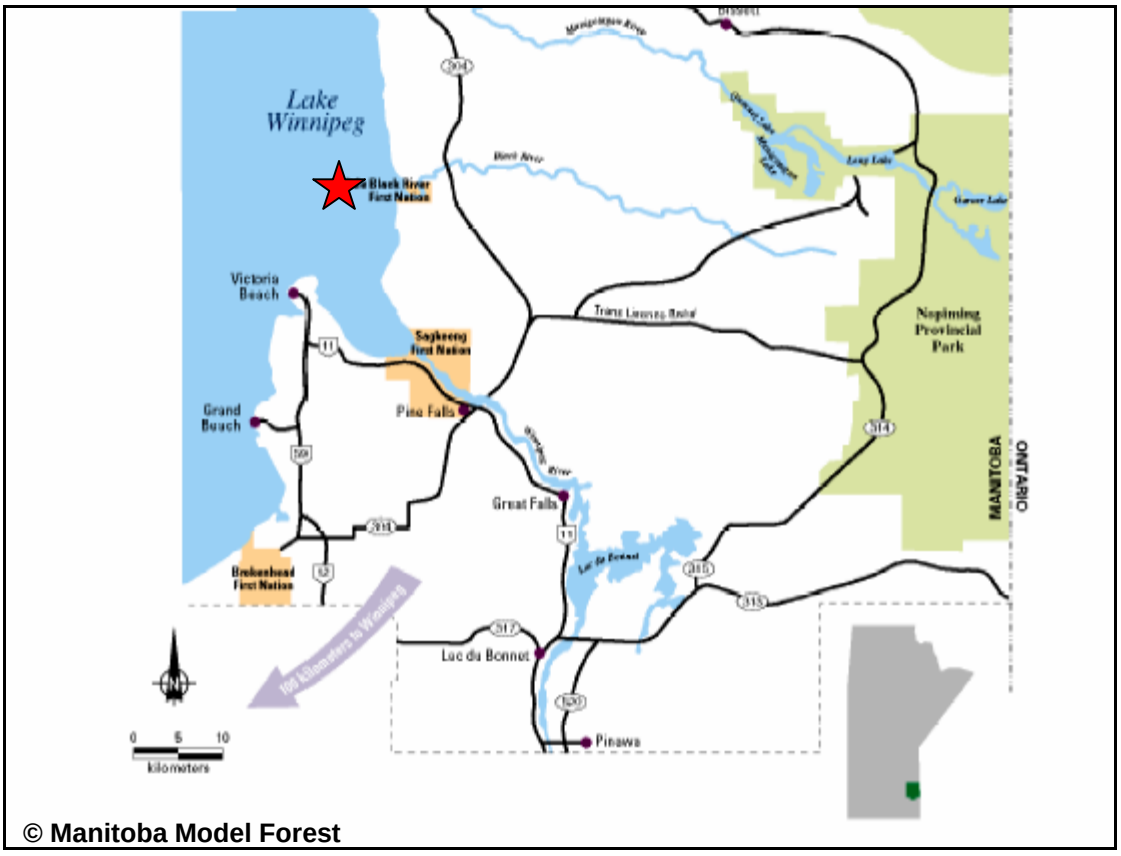

Figure 1. Location of Black River First Nation in the Province of Manitoba

The goals of the project were to:

1) Raise awareness to the impacts of climate change on traditional foods and medicines at Black River First Nation (BRFN).
2) Understand how climate change may be affecting abundance and distribution of selected traditional foods and medicines at BRFN and other First Nations in the boreal region.

3) Increase the capacity of BRFN, and potentially other First Nations in the boreal region, to plan for changes in traditional foods and medicines due to climate change and develop adaptation strategies to deal with those changes.

CIER met the goals of this project through community-based work including presentations to BRFN and community interviews, as well as external research to investigate the effects of climate change on selected traditional foods and medicines that are important at BRFN. In addition, CIER shared the project outcomes with the community of BRFN through presentations and a written report.

This final report outlines the current and predicted effects of climate change on traditional foods and medicines as well as recommendations on how BRFN can adapt to these. The findings of this study also serve as an example to assist other First Nations communities living in the boreal region with similar research projects or during adaptation planning processes.

2.0 Background

Climate change is a significant issue as it has environmental, social, economic and cultural impacts for all Canadians. Manitoba, due to its geographic position in the middle of the continent at relatively high latitude, is likely to face substantial impacts from climate change. It has been predicted that Manitoba's average seasonal temperatures could increase by 3 to 8°C by 2100 (Manitoba Clean Environment Commission and the International Institute for Sustainable Development, 2001). Along with this increase in temperature scientists predict changes in seasonal precipitation patterns, the number of frost-free days, and the number of severe weather events (ACIA 2004). These changes could significantly alter the distribution of plants and animals.

First Nations in the boreal region of Manitoba are particularly susceptible due to their strong and direct connection to the environment, which is integral to physical, social, economic, cultural, spiritual ways of life. Many First Nations within the region continue to harvest traditional foods and medicines that serve an essential role in maintaining community wellbeing.

The harvesting of traditional foods and medicines sustains many aspects of community life. In addition to health, nutritional, and economic values, traditional foods and medicines are integral

to social, cultural and spiritual identity since Indigenous Knowledge is passed down from one generation to the next during their hunting, gathering, and processing activities. Changes in species range as a result of climate change may lead to certain traditional food and medicines becoming rare or extirpated (no longer existing in a particular area) from a First Nation's territory.

Climate change impacts on species abundance and distribution has great potential to affect the day-to-day lives of First Nations in Manitoba. However, these impacts have not been fully investigated or documented in many First Nations. In this study, CIER used both western scientific and community-based research methods to identify climate change impacts on traditional foods and medicines and community members in BRFN as a First Nations community living in the boreal region of Canada.

3.0 Community-Based Research and Capacity Building

3.1 Presentation and Meeting with Community Liaison

CIER began the project by meeting with the BRFN community liaison at CIER in Winnipeg on December 20th, 2006. At this meeting CIER presented climate change and project information to the community liaison. The project work-plan and interview methodology were discussed.

3.2 Presentation to BRFN (First Community Visit)

CIER travelled to BRFN on January 15th, 2007 and delivered a presentation to BRFN Chief and Council and community members to build awareness about climate change in the boreal forest region, as well as to discuss the project work-plan. Prior to the visit, CIER created a poster describing the project and advertising the luncheon presentation, which was posted in various locations at BRFN by the community liaison.

During the presentation and following discussion, CIER received feedback about changes in climate, as well as other environmental issues, and how they are affecting the economic, physical, social, cultural, and spiritual roles of foods and medicines within BRFN. Some key traditional foods and medicines being used by BRFN were identified at this time.

3.3 Interviews (Second Community Visit)

CIER conducted interviews at BRFN with community members from January 22-25, 2007. Prior to the interview week, CIER prepared through regular communication with the community liaison and by creating a poster to notify BRFN when CIER would be in the community for interviews. CIER staff interviewed 9 BRFN community members including Elders, BRFN leadership, women, and resources users such as hunters, fishers, and gatherers. This number of interviews met our initial goal of seven-ten interviews. Some additional interviews were cancelled due to health issues and scheduling conflicts.

The interview topics included: background information of the interviewee; traditional foods and medicines that were most ecologically, socially, physically, and culturally important at BRFN; weather conditions and the effects of climate change on abundance and distribution of traditional foods and medicines, and possible adaptation strategies to climate change regarding foods and medicines. Prior to beginning the interview, the interviewee was told about the project and provided with an informed consent form, which was read through with them. This form outlined the purpose of the project, described how the information would be used and allowed them to specify their preference for anonymity. CIER also had an opportunity to present to the Adult Education class and employees from the Health Centre regarding climate change and build capacity about its effects and possible adaptation strategies. The resulting interviews were summarized and each interviewee was provided their own interview summary to provide feedback.

3.4 Community Interview Results

From speaking to the BRFN community liaison, interviewees, and other community members, we learned that many traditional foods and medicines used now and/or in the past are important to BRFN. However, in order to complete this study in the time and budget allowed, CIER could only focus on some of these traditional foods and medicines.

Based on comments at BRFN community presentations and during the interviews, we decided to focus on conifer trees (black spruce, white spruce, balsam fir), berries in general (e.g. blueberries, chokecherries, pin cherries, wild plums, strawberries, raspberries), and mammals (primarily moose, as well as deer and rabbit) for this report since these were the foods and medicines people mentioned most.

3.4.1 Use and importance of traditional foods and medicines

From our interviews we learned that traditional foods such as moose, sturgeon, whitefish, rabbit, wild rice, blueberries, pin cherries, wild plums, chokecherries, strawberries, raspberries and different “needle” trees or conifers (white spruce, black spruce, balsam fir) were all important traditional foods and medicines to BRFN members. We were told that these foods would always be present at traditional ceremonies, held four times a year (spring, summer, fall and winter), and at other events in the community. If the foods were difficult to acquire, people would save what they had for these events.

BRFN members said that the use of the traditional foods and medicines has decreased. Some perspectives were that the foods and medicines were more difficult to locate now and that younger people were less interested in harvesting foods and medicines. Some interviewees told us they preferred traditional foods to the store bought foods and found these foods to be better for them. Some people attributed the greater occurrence of sickness in the community (e.g. cancer, arthritis) to the greater reliance of community members on processed food instead of traditional food. While a few interviewees felt that the traditional foods were better for them, they eat these foods less often because they do not “trust” the foods anymore. People described finding “blisters” under the skin of rabbits and moose. This made them concerned about the quality of the meat and it would sometimes be thrown away.

Trees

We were informed that spruce trees (white spruce, black spruce) and other needle trees (balsam fir) were important medicines at BRFN and could help different kinds of illness. One interviewee articulated the importance of trees as, “everything grows with the trees”. He stated that berry bushes grow well under the shade of the trees, whereas if they were exposed directly to the sun they would “burn”. This person also said they used to chew the sap of the spruce trees, and use the pitch (i.e. resin) to fix canoes in the past.

Berries

BRFN community members told us that berries (e.g. blueberries, chokecherries, plums, pin cherries) were important to the community. Blueberries, chokecherries, plums and strawberries

were eaten fresh or made into jam. Some people mentioned that some of the berries (e.g. chokecherry and blueberry) were also used for medicine.

Blueberries are also economically important, although not as much now as they used to be. BRFN community members would “make their living” from picking and selling blueberries by the basket. Based on the description by a few people about camping trips for blueberry picking, it appears that berry picking has significant social importance as well.

Moose and other mammals

Moose is an important traditional food for BRFN members from older people to the younger generation. One hunter told us that people in the community would eat wild meat whenever they had access to someone who has killed moose or deer. Wild meat is often shared with family and/or elders in the community.

One interviewee told us that two rabbits would be placed in a pot when cooking a meal, so that everyone would be able to eat, which illustrates the common practice and importance of sharing food. Rabbits, although not eaten as much now as in the past, not only served as a food but also had medicinal value. It was indicated that rabbits eat medicines and people acquire those medicines from eating the rabbits. Rabbits were also used for other purposes; one interviewee said she would make blankets with the rabbit skin or put rabbit skin in her boots/shoes for warmth.

3.4.2 Observations about climate change

BRFN members told us they have been noticing changes in the weather/climate. Almost everyone said that generally, the winters are warmer/milder now. The following are observations that were communicated during our interviews:

- It used to be so cold in the past that you could hear the trees crack (between -40 C and –60 C).
- The stars seem close lately, which means the weather will be warm (if they seem far then it will be cold).
- The old people said that it was too early (Jan) for the weather to be like it was (it felt like spring).
- Increased temperature changes are causing community members to get sick.

Many people have noticed that there are greater fluctuations of weather within a season than in the past. The weather can change dramatically from week to week in the winter, whereas in the past, people said it would stay cold for most of the winter (for 2 to 4 months straight).

Many people also noticed changes in the amount of snow and snow conditions. The following are observations about snow that were communicated during our interviews:

- There used to be snow up to a person's armpits, but now there is hardly any snow.
- The hard crust that used to be on the top of the snow that is no longer there - this person was able to walk on the snow as a child but notices that children today are not able to do it.
- Snow does not hold as much water anymore and is now a similar consistency to powder
- People used to chip through 4-5 feet of ice on the lake, but now you may only get 3 feet.

It was mentioned that the summers are warmer than before and that is drier as well. One interviewee was more concerned about forest fires in the spring since he has observed that there has been less and less rain. Another person noticed that the rain falls unexpectedly now. It used to fall around April-May, but now it's more unpredictable (for example, it could fall in June-July). Another observation was that the winds have become stronger over the years. A few people thought there were more storms, and another person thought there were fewer storms now.

3.4.3 Effects of climate change on abundance and distribution of traditional foods and medicines

Most interviewees, when asked whether they thought that climate change was affecting abundance or distribution of traditional foods and medicines, indicated that climate change could be one cause, but there were many other causes as well. People indicated that development activities in the area of BRFN might be affecting their foods and medicines, including logging, a nearby pulp mill, and a hydro dam. However, several interviewees made connections between changes they have noticed in the weather over time, and how these changes might affect foods and medicines. Some people also said that harmful practises in and around the community such as the lack of recycling, burning garbage, and clear cutting, was harming the environment and contributing to climate change.

Trees

Community members have noticed that there are considerably less spruce trees around, but say this is due to the logging that is occurring in the area. Many BRFN community members were also concerned about spruce budworm outbreaks damaging the spruce and balsam fir trees in the BRFN area. Some people thought that climate change could be a factor in increasing spruce budworm damage. A major concern was how to control spruce budworm and whether it would be appropriate to control the spruce budworm through cutting out infected trees, as the local timber harvesting company has suggested, or by some other method.

In regards to climate change, one interviewee noticed that cones of some of the needle trees are open at times of the year when they are normally closed. In addition, he now has a hard time finding the foods and medicines he needs and has to go deeper in the bush to locate them.

Berries

Almost everyone said that berries were previously quite abundant in and around the community, but that it is now, and in the last few years, difficult to find berries (blueberries, chokecherries, pin cherries, wild plums, strawberries and raspberries). It was mentioned that if there was less snow, that might mean less moisture in the summer required for the plants to grow. In regards to chokecherries, a few interviewees said that the whole plant is no longer around, while more people said that the plants remain, but that only small dried out berries can be found on the branches. The chokecherries would flower in the spring, but the fruit will dry up before it has developed. Another observation was that when you do find blueberries, they are really small. A few people thought this change in berries might be because of climate change, or because of clear cutting (the berry plants burned up without the shade of the trees), and others were not sure what may be causing the change. We were told that when people cannot get certain wild berries, like blueberries, they sometimes buy canned or frozen berries.

Moose and other mammals

Interviewees told us that rabbit numbers fluctuate; a few people mentioned that there were fewer rabbits in past years, but they currently appear to be increasing. A similar pattern was observed for moose; that moose numbers had been decreased, but were now on the rise. It was indicated that moose numbers were increasing again, not due to any climate changes, but because hunters were more “organised” (i.e. communicated about where and how they were hunting

moose to best increase populations). Observations about rabbits included: the rabbit fur used to turn white and become thick in December, but this year in January, the fur was brown and relatively thin; and large amounts of snow correlate with high rabbit numbers.

4.0 External Research

4.1 How Information was Gathered

CIER conducted a literature review and set up phone conversations or face-to-face interviews with experts on climate change and the boreal forest region. Based on BRFN interview results, the focus of external research was the effects of climate change on conifer trees (white spruce, black spruce, and balsam fir), berries (blueberries and other berries), and moose. Conifer trees are important to BRFN as medicines, blueberries and other berries are important as both foods and for medicinal purposes, and moose is an important source of food. Rabbits were also important as both a food source and for medicinal purposes at BRFN. However, this study focuses on moose as currently little information exists for the effects of climate change on smaller boreal mammals such as rabbits.

Interviews were held in person with staff at Manitoba Conservation (Forestry Branch and Wildlife and Ecosystem Protection Branch) and researchers at the University of Manitoba (U of M) (Natural Resources Institute). Other interviews were conducted over the phone with researchers at the University of Winnipeg (U of W) (Center for Forest Interdisciplinary Research), U of M (Botany, Zoology, and Environment departments) and at the Canadian Forest Service. Information was also gained through e-mail correspondence with researchers at U of M, U of W, Natural Resources Canada, Environment Canada, and Sustainable Forest Management Network. A literature review was compiled by reviewing articles sourced from the U of M, U of W, and the Internet.

4.2 External Research Results

4.2.1 Predicted climate changes in the Canadian boreal forest

Climate, the typical weather that a region normally experiences, is important in determining what the boreal forest landscape looks like and how its ecosystems (communities of plants and animals) function. Past changes in climate have occurred slowly over centuries, and the concern is that the climate is changing more rapidly than forest species can respond. This makes it very difficult to predict how the boreal forest will change with changes in climate (Thompson et al. 1998).

There are computer models that try to predict the effects of climate change on the boreal forest. For example, one study looked at what the forests of Ontario would look like if current levels of carbon dioxide (CO_2) (a greenhouse gas) were doubled. This study found that a situation of elevated levels of CO_2 would create warming that would change species distributions due to extended growing seasons for plants and changes in animal habitat (Thompson et al. 1998). The types of plants and animals (composition) living in forests, and how they interact with each other (i.e. how the food chain functions), could also change (Thompson et al. 1998). A computer model does not offer an undisputable prediction of the future, but does provide us with a picture of the possible effects of climate change (ACIA 2004).

It is also important to realize that some studies using computer models focus on predicting climate change for a certain region (Burton and Cumming 1995, ACIA 2004). Within Canada, some regions will get warmer and drier, while others will become cooler and wetter. Climate change may be associated with improved forest health (e.g. increased vigour of plants due to longer growing seasons) in some places and forest health problems (e.g. drought stress or insect infestations) in other places (ACIA 2004). Overall, climate change is thought to make weather unpredictable from year to year (e.g. a dry year followed by a wet year) and within seasons (e.g. winter cold periods interrupted by unusually warm days) (Pruitt pers. comm. 2007).

4.2.2 Predicted effects of climate change on distribution and abundance of traditional foods and medicines in the boreal area

Trees

The trees of the boreal forest such as white spruce, black spruce, and balsam fir are important to First Nations as habitat for the traditional foods that they consume and as a source of medicines. Tree growth is affected by a combination of many climate-related factors like soil and air temperatures, soil moisture, sunshine, and wind (Briffa 1994). With a warming climate, the growing season may be extended, which could be seen as positive for tree growth. However, the warmer temperatures may also mean there will be periods of drought that could limit the growth of trees. For example, a study was done on stands of Alaskan white spruce trees in the interior of Alaska that looked at tree-rings (which show how a tree grows over time) compared to temperature records over the past 90 years. This study found that tree growth decreased with increased temperatures (Barber et al. 2000). It is also predicted that black spruce, that normally do well under moist, cool conditions may not do well across much of the boreal region of Canada with increasing summer temperatures. Drought stress may also make boreal trees susceptible to other causes of mortality like fire and insects (ACIA 2004).

In the boreal forest, fire is a major driver of change. Scientists are uncertain how climate change will affect forests and fires. Several models have predicted that the fire interval (time between fires) will be reduced and the size of fires will increase (Bergerson and Flannigan 1995). This could change the landscape of the boreal forest to include more jack pine and poplar trees (trees more tolerant to fire) and decrease white and black spruce. However, this may not be true for all areas of the boreal forest across Canada. For example, in eastern Canada, more frequent incursions of warm and humid air may occur. This would lead to more precipitation (rain and snow), thus actually reducing the fire interval (Bergerson and Flannigan 1995, Tardif pers. comm. 2007). Making predictions more difficult, over the last half of the past century, the practice of putting out forest fires, in order to protect communities and recreational areas, has resulted in a build up of dead tree and other plant material (i.e. stored fuel). This would mean that when fires do come through the boreal region in the future they could be larger and hotter than if previous fires had been allowed to burn (Thompson et al 1998, Tardif pers comm. 2007).

Human disturbance should also be considered along with climate change when looking at changes in the boreal forest. Logging can change the ages of forest stands (less old growth,

more young stands) and may change the types of vegetation (i.e. plants) that make up the forest. The effects of climate change may not be the same for a typical boreal forest area that is largely made up of spruce and balsam fir (as it has been in the past) and an area that has been changed to a mix of poplar-birch-balsam fir as a result of logging (Thompson et al. 1998).

Spruce Budworm

Many people at BRFN were concerned with the current infestation of spruce budworm that is damaging conifer trees in the Black River area. It is part of the natural cycle in the boreal for insect attacks on trees to occur from time to time. Although fire is a major cause of disturbance in the Canadian boreal forest, tree death caused by insects may be up to 1.3 – 2.0 times greater per year than tree death caused by fire (Volney and Fleming 2000).

Spruce budworms are always present in the forest, but there will inevitably be "outbreaks" (i.e. when populations do well and there is visible damage to an area of trees they are feeding on) that often last for a period of years. Spruce budworm requires that the right type of tree is available to feed on (prefers mature balsam fir and/or white spruce), but is also affected by climate and weather. In general, if all of their other needs are met, boreal forest insects survive, grow, and reproduce better in milder weather conditions (ACIA 2004, Fleming 2006).

Normally in Manitoba, there are no spruce budworm outbreaks for long periods and then outbreaks occur that last for 4-20 years. The Forestry Branch of Manitoba Conservation has observed spruce budworm outbreaks that have been persisting for unusually long periods of time (since approximately 1975) without completely collapsing. For example as Figure 2 illustrates, Ecoregion 90 (east side of Lake Winnipeg including the territory of Black River First Nation) and Ecoregion 91 (including the Whiteshell area and Northwest Angle) have had outbreaks lasting 28 years and 33 years respectively, and are currently increasing in intensity without ever having collapsed (Knowles pers. comm. 2007). Although it is not certain whether climate change is the cause of these particular extended outbreaks in Manitoba (Knowles pers. comm. 2007), climate and weather certainly play a role in determining how often outbreaks occur and how severe the damage is (Volney and Fleming 2000). For example, once spruce budworm larvae have hatched out and begun to feed on the needles of trees, a late spring frost can kill the new growth on trees and stop an outbreak (i.e. fewer spruce budworms will survive because their food source is reduced) (CANUSA 1985).

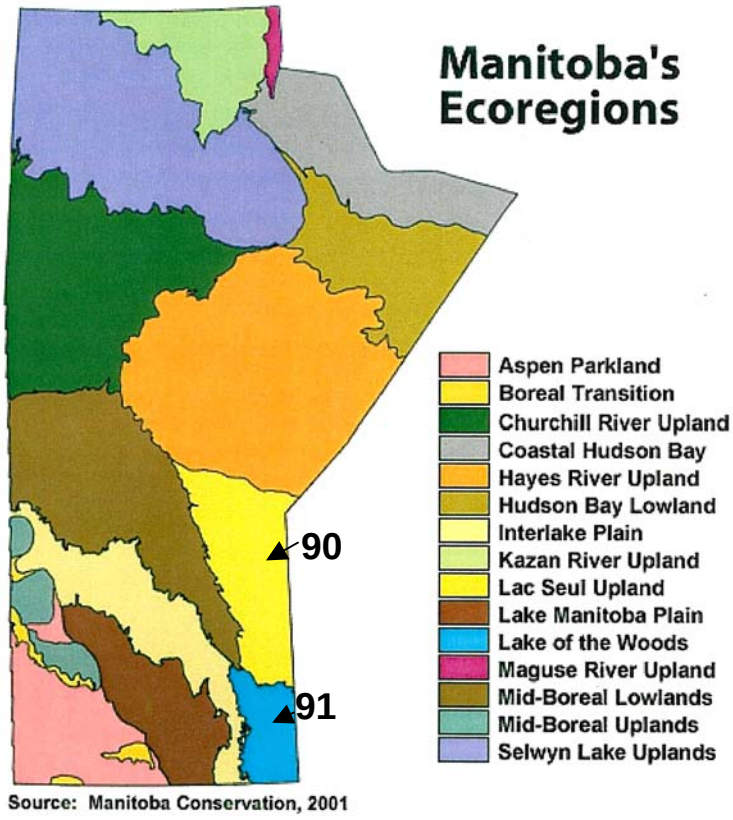

Figure 2. Map of Manitoba's Ecoregions: Lac Seul Upland = Ecoregion 90, and Lake of the Woods = Ecoregion 91

Once the spruce budworm emerges as a larva (caterpillar) in spring, it develops through a series of larval stages called "instars" (Figure 3). Temperature influences the budworm lifecycle. When the spruce budworm develops into the "6th instar", it is in the stage where it is able to do the most damage to trees by feeding. Manitoba Conservation, using a combination of field sampling and weather records, has observed that over a 130-year period, the trend is that spruce budworm now reaches the sixth instar two days earlier than it has in the past (Knowles pers. comm. 2007). This trend supports the idea that a warmer climate will affect spruce budworm outbreaks in the future.

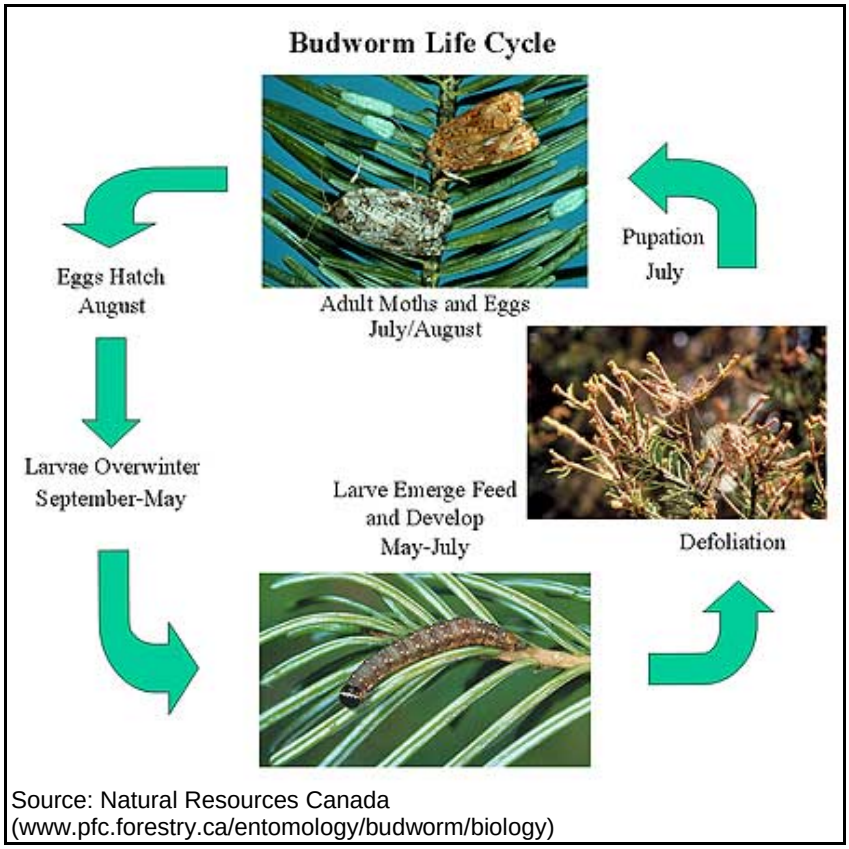

Figure 3. Spruce Budworm (*Choristoneura fumiferana*) Life Cycle

Berries and Other Plants

There is a lack of western scientific research that looks at how climate change affects the abundance and distribution of berry producing plants in the boreal forest of Canada. However, some observations about how climate affects berry production in general have been made.

The abundance and distribution of berries depends on many climate-related conditions. For example, the flower buds of blueberries (*Vaccinium* spp.) are produced in the fall (before they flower) and need to be covered by enough snow over the winter to protect the buds from frost damage (Hall et al. 1979 *cited in* Morgan 1999). Once berry plants begin to flower, a late frost or dry conditions may stop plants from flowering, and this would affect the amount of berries. A

good crop of berries also depends on whether there is enough rainfall during flower bud and fruit development (Benoit et al. 1984 *cited in* Morgan 1999).

Some observations about how climate change could affect traditional foods (berries) were gained from researchers working with First Nation communities across Canada. In addition to Black River in southeastern Manitoba (during this study), the Teetl'it Gwich'in in the Northwest Territories, and the Cree Nation of Wemindji in Eastern James Bay have noticed in recent years that certain types of berries have not been ripening fully ('baking') (Berkes pers. comm. 2007). Other First Nations, such as Shoal Lake First Nation in northwestern Ontario, have talked about having to change where they usually went to harvest berries. In years that were hot and dry harvesters would have to go to other more shaded areas (where there is more moisture) (Davidson-Hunt pers. comm. 2007). Although the causes of poor berry production require further study, climate-related factors such as extremes of temperature and/or dryness during the ripening season play a role.

Certain plants, such as blueberries (*Vaccinium spp.*) may be abundant in areas that have been disturbed through fire or clear-cut logging (Hall et al. 1979 *cited in* Morgan 1999, Berkes and Davidson-Hunt 2006). However, removing trees through timber harvesting would also increase heat and fluctuations in temperature that could affect berry production. Blueberries also require fire to renew plants (remove dead plants) and control succession and if fire is suppressed, such as in areas that are important for timber harvesting or near communities and cottages, then berry production may be affected (Davidson-Hunt pers. comm. 2007).

Distribution of Plants

Plants, although we think of them as not being able to move, actually can (over years and decades) move into new territory through creeping roots and seeds carried by wind, water, or animals. Weather satellites that took measurements of absorption of light by vegetation between 1981-1991 showed that vegetation at northern latitudes had increased (Pitelka 1997). Growing seasons have also lengthened (Pitelka 1997).

It may be possible for plants to relocate as the climate changes as they have in the past. However, if the climate changes too rapidly, or human activity such as forestry operations fragment the habitat, it may be more difficult for plants to find suitable habitat and chances of survival will be reduced. Trees and shrubs or plants with heavy seeds that are not easily carried

by the wind will be the most vulnerable to rapid changes in climate (may include some berries such as chokecherries or plums). Invasive or weedy species may be able to move quite easily into areas where native plants are not able to thrive, either from change in climate or loss of habitat (Pitelka, 1997).

Moose and other mammals

With climate change, the abundance of boreal wildlife and their distribution (where they live across the landscape) may change. Moose and other mammals are affected by changes in their environment such as, temperature, where they find food and shelter, competition from other animals, and by diseases. For example, with less severe winters and less snow accumulation in the boreal, white-tailed deer will be able to move northwards into the range that is currently occupied by moose. The consequences of this are, while there will be more habitat available for one animal (deer), there will be less available for another animal (moose), and possibly and increase in predators such as wolves that would be attracted by the increase in food supply (both deer and moose) (Thompson et al. 1998). In addition, deer carry parasites such as brainworm and liver flukes that can be passed to moose and are usually fatal. Warmer temperatures during summer months may also stress large animals like moose and require them to expend valuable energy to keep themselves cool, as well as make them more vulnerable to parasites (Crichton pers. comm. 2007). In northwestern Minnesota, a recent study examined why the moose population in that area was in severe decline. The study concluded that since predators or hunting were not issues in the area, that higher temperatures over the past 40 years might be contributing to the decline (Smith 2007). For the area on the east side of Lake Winnipeg that includes Black River First Nation, Manitoba Conservation notes that there is plentiful habitat and that the area could support more moose than it currently does. In this region, other factors in addition to climate need to be considered such as over-hunting of cow moose that could significantly reduce populations (Crichton pers. comm. 2007).

Climate change may also affect snow conditions that will impact boreal mammals. For example, small mammals such as mice and voles (an important food source for other animals such as owls and foxes) require there to be sufficient snow cover (in central Manitoba on the east side of Lake Winnipeg this is approximately 25 cm in thickness) to successfully over-winter. If snow cover is not sufficient then certain animal populations will not be as abundant. Climate change may also bring influxes of warm air during the winter that would cause a hard icy crust to form on

top of the snow that affects the movement, and cuts the skin on the legs, of large animals like caribou or moose (Pruitt pers. comm. 2007, Pruitt 2007). However, lighter mammals such as rabbits may not be affected because they can easily travel over the hard crust of snow (Pruitt 2007).

4.2.3 Research Conclusions

After reviewing scientific articles and talking to those using western science to study the boreal forest, our conclusion is that, although many predictions have been made using the best available knowledge, the long-term effects of climate change on the boreal region in Canada remain largely unknown.

Despite an incomplete picture of the future, it is clear that the climate plays an important role in determining where plants and animals of the boreal live and how abundant they are. First Nations in Canada have already noticed changes in distribution and abundance of traditional foods and medicines, and climate would certainly play a role in any future changes. In recent years, BRFN has noticed that summers are warmer and drier, winters are milder, there is less snow and the consistency of snow has changed, and weather is generally more unpredictable (e.g. spring-like weather in January). These changes appear to correspond with predictions that scientists have made for the boreal region such as increased temperatures and unpredictable weather. Although other factors, such as forestry operations and hydro development may be affecting the abundance and distribution of BRFN's traditional foods and medicines (e.g. conifer trees, berries, and moose), the effects of climate change will only exacerbate existing stresses on these foods and medicines.

Knowledge gaps need to be filled. More climate change information exists for Arctic regions of Canada (ACIA 2004) than for southern boreal forest areas such as where the community of BRFN is located. First Nations could benefit from further study specific to traditional foods and medicines in the boreal forest, such as the effect of climate change on berry plants or on mammals such as rabbits.

5.0 Adaptation Strategies

5.1 BRFN Existing and Suggested Adaptation Strategies

BRFN has addressed climate change in the past. The BRFN Environment Department undertook a Global Warming Monitoring and Education project (2004-2005) that engaged youth to collect scientific data on various parameters (e.g. plants, animals, soil, temperature) in different boreal forest study plots to track any changes that may be caused by global warming. Unfortunately, the BRFN Environment Department is not operational due to lack of funding, and so long-term climate change studies were unable to continue. BRFN Chief and Council indicated that continuation of both the Environment Department and multi-year projects like the global warming monitoring are very important to the community and they are currently seeking assistance to re-start the department and its programs. Given the large gaps in information about climate change impacts on traditional foods and medicines in the southern boreal region it would be beneficial for BRFN to continue monitoring changes over the long-term to better understand the impacts of climate change and to assist in planning adaptation strategies.

Interviewees for this project commented about the current lack of programs to address climate change at BRFN. Of the community members that were interviewed, most had observed climate changes (current conditions differing from past conditions), but did not indicate that these changes were directly affecting the traditional foods and medicines that they use. The community members interviewed did not suggest what adaptation strategies to climate change could be undertaken at BRFN. This could be because community members expressed greater concern about how environmental factors such as timber harvesting and hydro development are currently affecting the traditional foods and medicines at BRFN. However, some of the community members talked about how activities in the community might be contributing to climate change, such as clear cutting and lack of recycling. One interviewee said that timber harvesting removes the trees, which affects the climate, which in turn affects the traditional foods and medicines at BRFN. CIER provided community members who were concerned about the lack of recycling with information about organizations that could help with education and/or assist in setting up a recycling program at BRFN.

At the BRFN band meeting where CIER shared results of the project, community members commented on possible adaptation strategies to climate change at BRFN. Suggestions were to control spruce budworm (as infestations may be enhanced by climate change) with biological

control methods such as promoting health of the forest to increase bird populations or other organisms that feed on the budworm. Another suggestion was for the community to reduce the garbage they produce (because the burning of garbage contributes to greenhouse gases) and become more involved in environmental issues by starting a recycling program at BRFN.

5.2 Potential Adaptation Strategies for First Nations in the Boreal Region

CIER conducted research on potential adaptation strategies to address the effects of climate change on traditional foods and medicines at BRFN and other First Nations in the boreal region. It is important to note that these are only suggestions and that the specific adaptation strategies applied would depend on whether the First Nation thinks it is an appropriate strategy for their First Nation, and whether they have the capacity to undertake the strategy. More research is necessary to determine whether the following adaptation strategies are appropriate and effective for specific areas. The First Nation may also want to investigate further adaptation strategy options.

CIER recommends that BRFN undertake a planning process within their community to determine what adaptation strategies would be best suited to their community. CIER provided BRFN with the 'Climate Change Planning Tools' Guidebooks that CIER developed, which guides First Nation communities through a planning process to develop solutions and adaptation strategies to the challenges that climate change presents, while working to achieve their long-term vision.

1) Plant Trees

A First Nations community facing the loss of traditional foods and medicines from climate change and other environmental factors such as timber harvesting, could organize a tree planting project. Planting trees is a good way to offset the impacts of climate change by providing more plants to take in carbon dioxide and produce oxygen, as well as create habitat for other plants and animals used as traditional foods and medicines by First Nations. Tree planting can also be combined with planting shrubs or understory plant species to renew the abundance of traditional foods and medicines, such as conifer trees and berries, and increase habitat diversity. It would be important to plant trees and plants that are native to the area and help to maintain the ecological integrity of the forest. The Manitoba Forestry Association has a woodlot program to help interested individuals or communities decide which species to plant and develop woodlot management plans (Manitoba Forestry Association website 2007). Tree

planting can be an opportunity to involve youth and the whole community in taking action to mitigate (lessen the effects of) climate change.

2) Control Spruce Budworm

The community of BRFN is particularly concerned with increasing spruce budworm damage to spruce and balsam fir trees that are important to the community as traditional medicines. As discussed in the 'External Research' section of this report, the outbreak of spruce budworm in the BRFN area (east side of Lake Winnipeg) may be due in part to milder climate conditions over the last few decades. When asked about adaptation strategies to deal with spruce budworm outbreaks, Manitoba Conservation, Forestry Branch, indicated that an option for spruce budworm control would be to use an insecticide called Mimic (Tebutinozide). This product acts like a naturally occurring hormone (causing the insects to molt and stop feeding quickly) that only affects moths and is less toxic than many other insecticides (Knowles pers. comm. 2007). It is important to note that some members of the BRFN community expressed opposition to using such a method, since they believe it could potentially harm the environment. This product affects the group of insects called Lepidoptera (butterflies and moths, including spruce budworm which is a moth species). More information is needed to find out whether it affects other species (e.g. other insects or other animals) in the environment. Possible biological control methods such as increasing native bird populations or other organisms that feed on the budworm should be investigated further. There is also a naturally occurring bacterium called *Bacillus thuringiensis* (Bt) that can be used as a biological insecticide. The bacterium Bt infects and kills certain insects, and is commonly used against leaf and needle-feeding caterpillars such as the spruce budworm (Cranshaw 2003).

3) Build Shade Structures

Some BRFN community members have noticed berries (blueberries and other berries) drying up before they are able to ripen fully, which affects the abundance of berries available to the community as foods and medicines. External research revealed that other First Nations in Canada have experienced the same phenomenon in recent years that may be due to warmer, drier summers, berry plants being exposed to temperature and moisture fluctuations in clear-cut areas, or other causes. There is some evidence that shade is necessary for optimal growth of certain berry plants. A study in southeastern Manitoba, comparing blueberry growth following a spring burn under wooden screens providing different levels of shade, found that blueberries under intermediate shade grew faster, had larger leaves, longer and stouter shoots, and

experienced more favourable moisture conditions (Hoefs and Shay 1981). Shade may also protect berries from frost damage (Hoefs and Shay 1981). With some background research into the appropriate amount of shade to provide, First Nations communities could create shade structures for blueberries in traditional harvesting areas where they are noticing poor berry crops due conditions such as dry weather or lack of tree canopy. Timber harvesting in the area may leave remnant wood (i.e. slash) that could be used as a source of building materials for shade structures. The tree planting adaptation strategy presented earlier should also be considered as a way to provide shade and habitat for berries used as traditional foods.

4) Change Plant Harvesting Locations and Times

First Nations could adapt to changes in climate that affect plant distribution by changing their berry and other plant harvesting locations. Groups of harvesters could travel to new areas where berries or other plants are available. One BRFN interviewee mentioned that they had a difficult time gathering Labrador tea last year, since it only flowered for an unusually short period and flowering is the desirable time to harvest the plant. If such situations happen more often in the future due to climate change or other environmental factors, community members could gather groups (possibly school groups) together to pick plants that are only available during a short window of time. This adaptation strategy could have positive effects in a First Nation because it is an opportunity to pass knowledge on to the next generation.

5) Adjust Hunting Activities

Balancing the need to harvest traditional foods while considering the added stresses of climate change is important. For example, moose, a valued traditional food source for the community of BRFN, may be affected by a warming climate through increased heat stress and susceptibility to diseases. Therefore it would be important to continue practising good stewardship of the land and animals by putting the least possible amount of hunting pressure on moose populations in the area. A way to do this is for First Nations to keep track of how many moose are hunted and follow rules, such as no hunting of cow moose, to increase populations in the area.

If moose do move farther north in response to climate change as predicted, community members may need to travel further north to hunt moose. This may mean that BRFN community members would be hunting moose in other First Nations' traditional territories. If this did happen, it would be important to approach neighbouring communities with appropriate protocols to request permission to hunt in their territories.

Another adaptation strategy would be to hunt different animals as species distributions change. For example, if deer populations increase in the area of BRFN due to habitat changes, community members may choose to hunt more deer than moose. Adopting this strategy would of course depend on whether the First Nation thought it was a culturally appropriate option to change a traditional food source.

6) Share and Exchange Foods

If traditional foods and medicines change abundance and distribution due to climate change, an option would be to partner with other First Nations to share, exchange, or trade these. For example, if moose are more available in First Nation A compared to First Nation B, but wild rice is more available in First Nation B compared to A, these two communities could arrange to share or trade these traditional foods. This adaptation strategy could be an opportunity to reinvigorate the traditional economies of First Nations.

7) Reduce Greenhouse Gas Emissions

'Reduce greenhouse gas emissions' is not a specific adaptation strategy, but is discussed here as several mitigation activities to improve environmental conditions and reduce emissions that contribute to climate change.

Set Up a Recycling Program

As discussed by BRFN, one way to take action to reduce garbage and air pollution produced by burning garbage would be to implement a recycling program. BRFN could contact organisations such as Green Manitoba, the Manitoba Product Stewardship Corporation, and Resource Conservation Manitoba that could provide education and assistance in setting up a recycling program in the community.

Practice Sustainable Transportation

BRFN is located approximately two hours outside of Winnipeg and trips are often made to and from the city. BRFN could reduce greenhouse gas emissions through sustainable transportation activities such as carpooling to Winnipeg, regular maintenance of personal vehicles and fleets (e.g. school buses, road maintenance vehicles), considering energy efficiency when buying new vehicles, use of fuels containing ethanol or bio-diesel where available, and implementing an "idle-free" policy in the community. First Nations such as BRFN could access information and

resources through Natural Resources Canada's programs including ecoEnergy for Fleets Initiative (to cut fuel costs and reduce emissions of fleets), ecoMobility program (to help communities reduce passenger transportation emissions), and the ecoAuto program (information on buying fuel-efficient vehicles and rebates towards the purchase of more fuel-efficient vehicles). First Nations could also join the 'Commuter Challenge' through Resource Conservation Manitoba to create awareness of climate change in their community and adopt sustainable transportation practices.

Build Energy Efficient Buildings

Greenhouse gas emissions from houses and other buildings at BRFN could be reduced by retrofitting older buildings and including energy efficiency measures into new ones. Insulation, weather stripping, energy efficient lighting and furnaces could be installed to use less energy and reduce emissions (if using electric heat, emission reduction will not be large, but if using heating fuel, these measures will be more effective at reducing emissions). Manitoba Hydro's Power Smart program and well as Natural Resources Canada's R-2000 program can assist with information and incentives for making these changes. Better construction of buildings will also help them stand up to increased weather extremes, such as increased precipitation or stronger storms, that may come with climate change.

6.0 Sharing Results and Capacity Building

The third visit on March 6th, 2007 CIER met with Chief, Council, Elders, and other community members. CIER gave a PowerPoint presentation and answered questions following the presentation. The presentation was a summary of what was learned from the interviews and external research, and potential adaptation strategies to the effects of climate change on the traditional foods and medicines at BRFN.

The community was engaged and they shared the following:

- Observations about climate change and other changes attributed to industry in the area (timber harvesting)
- Suggestions for possible solutions to the spruce budworm infestation that is occurring in the area of BRFN.
- A suggestion for the community to contribute to environmental health by starting a recycling program

- A question regarding how information would be shared in the final report

CIER addressed comments and questions following the presentation. At this time CIER also presented the Chief with CIER's Climate Change Planning Tools Guidebooks (available online at: http://www.cier.ca/information-and-resources/publications-and-products.aspx?id=412). The comments received by BRFN were then used to contribute to this final report.

CIER compiled a community research manual, which outlined research methods, lessons learned, Indigenous Knowledge (from BRFN interviews) and western scientific information about climate change impacts and adaptations regarding the abundance and distribution of the selected traditional foods and medicines. CIER provided copies of the community manual to the BRFN Band Office, Health Centre, and BRFN School, places where the majority of BRFN community members would be able to access it. The material presented in the manual was included in the final report.

7.0 Conclusion

Traditional foods and medicines, while not used as frequently as in the past, are still important to the people of BRFN. This study focused on conifer trees, berry plants, and moose that are currently important for health and nutrition of the community and also have spiritual and cultural importance.

Community-based research identified that BRFN community members had concerns regarding the impacts of timber harvesting, a nearby pulp mill, and hydro dams on traditional foods and medicines in the area. Since these other environmental issues are so prevalent at BRFN, it was difficult to attribute observed changes in abundance and distribution of traditional foods and medicines to climate change. However, presentations for the project stimulated discussions with community members and increased awareness about how climate change, in addition to other factors such as pollution and reduction of habitat, can affect the distribution and abundance of their traditional foods and medicines.

Our external research found that all of the traditional foods and medicines that we focused on at BRFN are vulnerable to climate change. Information gaps in the current research still exist for climate change impacts on the southern boreal forest of Canada in general, and climate change impacts on First Nations traditional foods and medicines, in particular. Although some

information exists on adaptation strategies in Arctic regions of Canada, there is a need for more research on how First Nations can adapt to climate change impacts in the southern boreal region.

The BRFN community is aware of the potential impacts of climate change, and with sufficient funding and capacity building measures in place, could conduct further research or planning for adaptation strategies. BRFN has shown a keen interest in environmental education and research in their community through the creation of a BRFN Environment Department and involvement of youth in a global warming monitoring project. Unfortunately, due to inadequate funding, limited human resources and other factors, these initiatives were suspended. CIER's Climate Change Planning Tools Guidebooks (which were provided to BRFN) can assist with planning for adaptation strategies.

Continuation of programs such as BRFN's Global Warming Monitoring Program would be useful in filling knowledge gaps on the long-term effects of climate change on traditional foods and medicines in the boreal region. Monitoring will also help First Nations communities prepare strategies to adapt to any changes in abundance and distribution of traditional foods and medicines that may occur with a changing climate.

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